International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 2 Issue 3, March - 2013

Dawn Of A New Concept Of Communication: Broadband Technology - A Review

Mitesh Sharma, Amit Mishra, Rajendra Purohit

Department of Computer Science
Jodhpur Institute of Engineering & Technology
Jodhpur

Abstract— As broadband is gaining worldwide popularity the scope to connect more people via broadband is simultaneously increasing. Broadband wireless access networks are providing more capacity and coverage. Where wired connections are costly and sometimes not easy to implement, at those places Wireless networking has offered an alternative solution to the problem of information access. They have changed the way people communicate and share information by eliminating troublesome factors of distance and location. This paper presents an outline of broadband technologies with bandwidth management.

Keywords- Broadband, bandwidth management,benefits etc.

I. INTRODUCTION

Broadband communication is becoming a foundational element of the entire economy, supporting entire industries, transforming not only how people work, but how they lead their lives. As wireless technology represents an increasing portion of the global communications infrastructure, it is important to understand overall broadband trends. Sometimes wireless and wireline technologies compete with each other, but in most instances, they are complementary. For the most part, backhaul transport and core infrastructure for wireless networks are based on wireline approaches, whether optical or copper. This applies as readily to Wi-Fi networks as it does to cellular networks.

The Industrial Revolution during the past two centuries produced the most development in the history of mankind. But that period of unparalleled growth will be overshadowed by the current technological revolution, namely, the Information and Communication Technology (ICT) revolution. This revolution will not only benefit individual citizens but will have a tremendous impact on national economies and the global economy as a whole. As a result of ever-increasing global connectivity, the amount of information that can be transmitted electronically has grown exponentially, resulting in unprecedented ease of communication in most of the countries.

To realize the true success of the ICT revolution, broadband connectivity is needed, as it is not only information that is shared but also voice, images, video, etc. There is no agreed definition of broadband, but it is usually recognized by its higher transmission speed and ‘‘always-on’’ connectivity. Broadband is at the heart of the convergence of telecommunication, information technology, and broadcasting. Therefore, there is a great need for modern high-tech communication infrastructure since the focus of applications is on interactivity rather than just information sharing.

There are multiple factors contributing to explosive growth in data consumption, but first and foremost is the combination of powerful mobile computing platforms and fast mobile broadband networks. Despite the number of vendors and platform types available on the device side, the industry is converging on what might be considered a “standard” platform for smart-phones and also one for tablets. Even if implemented differently, these platforms have the capabilities shown in Figure 1.

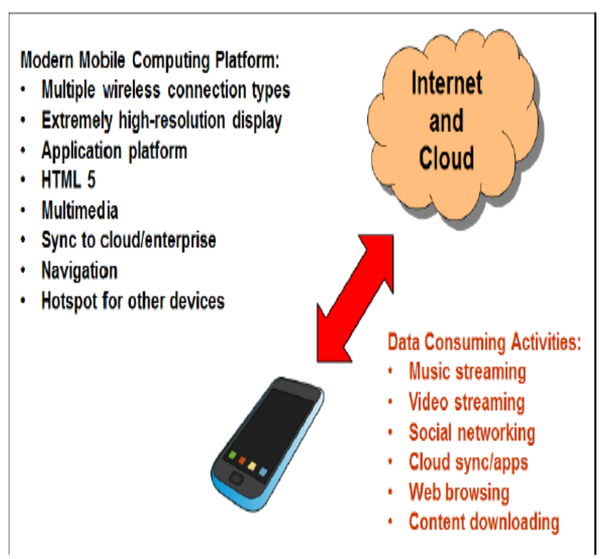

Figure 1: Modern Mobile Computing Platform and Data Consumption

The rich capabilities of these mobile platforms enable them to consume ever larger amounts of data through activities such as music and video streaming, social networking, cloud-based synchronization and applications, Web browsing, and content downloading.

Table 1: Data Consumed by Different Streaming Applications

Application	Throughput (Mbps)	MByte/hour	Hrs./day	GB/month
Audio or Music	0.1	58	0.5	0.9
			1.0	1.7
			2.0	3.5
			4.0	6.9
Small Screen Video (e.g., Feature Phone)	0.2	90	0.5	1.4
			1.0	2.7
			2.0	5.4
			4.0	10.8
Medium Screen Video (e.g., Smartphone Full-Screen Video)	1.0	450	0.5	6.8
			1.0	13.5
			2.0	27.0
			4.0	54.0
Larger Screen Video (e.g., Netflix Lower Def. on Tablet or Laptop)	2.0	900	0.5	13.5
			1.0	27.0
			2.0	54.0
			4.0	108.0
Larger Screen Video (e.g., Netflix Higher Def. on Laptop)	4.0	1800	0.5	27.0
			1.0	54.0
			2.0	108.0
			4.0	216.0

With declining voice revenue, but increasing data revenue, cellular operators face a tremendous opportunity in continuing to develop their mobile broadband businesses. Successful execution, however, means more than just providing high speed networks. It means addressing demand that is growing at an extremely rapid rate. It also means nurturing an application ecosystem, delivering complementary services, providing a compelling customer experience, and supplying attractive devices. These are all areas in which the industry has done well.

II. *WIRELESS VERSUS WIRELINE*

Wireless technology is playing a profound role in networking and communications, even though wireline technology such as fiber has inherent capacity advantages. The overwhelming global success of mobile telephony and now the growing adoption of mobile data conclusively demonstrate the desire for mobile-oriented communications. Mobile broadband combines compelling high-speed data services with mobility. Thus, the opportunities are limitless when considering the many diverse markets mobile broadband can successfully address. Developed countries continue to show tremendous uptake of mobile broadband services. Additionally, in developing countries, there is no doubt that 3G and 4G technology will cater to both enterprises and their high-end mobile workers and consumers for whom mobile broadband can be a cost-effective option competing with digital subscriber line (DSL) for home use.

Relative to wireless networks, wireline networks have always had greater capacity and historically have delivered faster throughput rates. Even if mobile users are not streaming full-length movies in high definition, video is finding its way into an increasing number of applications including education, social networking, video conferencing, business collaboration, field service, and telemedicine. Over time, wireless networks will gain substantial additional capacity through all the methods discussed in the next section, but they will never catch up to wireline. One can understand this from a relatively simplistic physics analysis:

- Wireline access to the premises or to nearby nodes uses fiber-optic cable.
- Capacity is based on available bandwidth of electromagnetic radiation. The infra-red frequencies used in fiber-optic communications have far greater bandwidth than radio.
- The result is that just one fiber-optic strand has greater bandwidth than the entire usable radio spectrum.

III. BROADBAND TECHNOLOGY

Broadband Technologies are very useful in all respect of life utilities. Following are the recent technologies:

a) Wi-Fi: Wi-Fi is the first high-speed wireless technology to enjoy broad deployment, most notably in hotspots around the world – including homes and offices, and increasingly cafes, hotels, and airports. In specification Wi-Fi hotspots became popular almost immediately and have been applauded by road warriors for their ability to improve productivity. Wi-Fi is limited, however, by its range: high-speed connectivity is possible only as long as a user remains within range of the wireless access point, which is optimum within 300 feet. Wi-Fi was one of the earliest high-speed wireless data technologies and now benefits from a broad availability of supporting products and technologies. Intel Centrino mobile technology optimizes performance in mobile data platforms, helping users get the most from the expanding Wi-Fi infrastructure. Some of the newest platforms even support multiple Wi-Fi standards (e.g. 802.11a, b and/or g) for compatibility among several wireless networks.

b) WiMAX: WiMAX is an emerging technology that will deliver last mile broadband connectivity in a larger geographic area than Wi-Fi, enabling T1 type service to business customers and cable/DSL-equivalent access to residential users. Providing canopies of coverage anywhere from one to six miles wide (depending on multiple variables), WiMAX will enable greater mobility for high-speed data applications. With such range and high throughput, WiMAX is capable of delivering backhaul for carrier infrastructure, enterprise campuses and Wi-Fi hotspots. WiMAX will be deployed in three phases. Phase one will see WiMAX technology using the IEEE 802.16d specification deployed via outdoor antennas that target known subscribers in a fixed location. Phase two will roll out indoor antennas, broadening the appeal of WiMAX technology to carriers seeking simplified installation at user sites. Phase three will launch the IEEE 802.16e specification, in which WiMAX-Certified* hardware will be available in portable solutions for users who want to roam within a service area, enabling more persistent connectivity akin to Wi-Fi capabilities today.

c) 3G: 3G is an ITU specification for high-speed wireless communications. This worldwide wireless connection is compatible with GSM, TDMA, and CDMA. Next-generation 3G cellular services will provide a long-range wireless access canopy for voice and data. Carriers worldwide are now in the process of deploying 3G network infrastructure across urban, suburban and highly trafficked rural areas. Next-generation 3G cellular services will create broad-range coverage for data access across wide geographic areas, providing the greatest mobility for voice communications and Internet connectivity. 3G services will enable highly mobile users with laptops and other wireless data devices to bridge the gap between higher bandwidth WiMAX hot zones and Wi-Fi hotspots. New devices optimized for 3G communications are beginning to reach the marketplace. Such devices include cell phones that can also provide interactive video conferencing, as well as PDAs that can provide full-playback DVD services. 3G technologies are designed to provide the greatest mobility and are intended for devices whose primary function is voice services with additional data applications as a complement to those services.

d) UWB: Ultra-Wideband (UWB) is a future wireless personal area network (WPAN) technology capable of high throughput (up to 400Mbps) at very short range (less than 30 feet). UWB will likely be utilized to enable wireless USB access for connecting computer peripherals to a PC and multiple components in the consumer electronics stack – e.g. home theater equipment. UWB has the throughput capability to simultaneously distribute multiple high definition video streams. Intel engineers are working with a variety of industry leaders to develop a standard UWB radio platform. Made up of two core layers – the UWB radio layer and the convergence layer – the UWB platform will serve as the underlying transport mechanism for different applications that would operate on top of the single radio, such as wireless universal serial bus (USB), IEEE 1394, the next generation of Bluetooth and Universal Plug and Play.

IV. THE NEED FOR BROADBAND WIRELESS IN DISASTER AND EMERGENCY RESPONSE

Broadband wireless connectivity can provide significant capabilities at a disaster or emergency site to increase the safety of the responders and to increase the effectiveness of the response. A number of related factors are increasing the need for high data rate network connectivity for disaster and emergency response. Brief summary of these factors are given below:

- The disaster and emergency management community has, over time, developed effective processes to respond to crises. An Incident Command System (ICS), customized to the scale and nature of the event, is used by federal, state, and local agencies responding to a crisis.
- Existing communications support is focused on voice. Land mobile radio (LMR) systems can provide local and regional connectivity, while cellular telephone systems can provide national connectivity. However, data connectivity is becoming increasingly important as part of the IT infrastructure required for the ICS.
- Communications is required locally within the disaster site, within the local region, and nationally (or even globally in some cases). Thus, there is a need for at least three tiers of communications infrastructure:
  - **(i)** local connectivity, e.g., using wired and wireless local area network (LAN) technology;
  - **(ii)** backbone or backhaul connectivity, which is the focus of our work;
  - **(iii)** wide area network (WAN) connectivity in the form of the global Internet or a private network. The backbone network may connect directly to the WAN or a fourth component – realized using satellite communications or terrestrial wireless – may be needed to connect the backbone to the WAN.
- Responders cannot rely solely on the public communications infrastructure. It may be destroyed or largely destroyed by the disaster, it may be non-existent as is the case in many rural areas, or it may be saturated by public safety users, the press, and others.
- There is an increasing need for interoperability to support multi-agency response. Large scale disasters require response by agencies in adjoining jurisdictions. Many incidents also require the involvement of multiple federal, state, and local agencies with different charters. The lack of interoperability is most evident today with LMR systems where, for example, fire fighters from one city cannot communicate directly with fire fighters from an adjoining city who are trying to assist.
- The communications infrastructure must be flexible to satisfy a variety of situations. Different locations and

different types of emergencies and disasters may require use of different applications, connectivity for different types of end-user equipment, support for different types of users, operation in different environments, etc. Clearly, all equipment used for emergency and disaster response must be rugged to survive transport and harsh conditions and easy to use by responders who need technology to be "transparent" so that they may focus on life-critical tasks. It is also important to note that responders are focused on their immediate and critical mission. Technology that shows clear, immediate, and significant benefits will likely be adopted. Technology that is confusing, ineffective, or requires significant training will likely be ignored.

V. BANDWIDTH MANAGEMENT

Given huge growth in usage, mobile operators are either employing or considering multiple approaches to manage bandwidth:

- **More spectrum.** Spectrum correlates directly to capacity, and more spectrum is becoming available globally for mobile broadband. In the U.S., the FCC National Broadband Plan seeks to make an additional 500 MHz of spectrum available by 2020.
- **Unpaired spectrum.** Technologies such as HSPA+ and LTE allow the use of different amounts of spectrum between downlink and uplink. Additional unpaired downlink spectrum can be combined with paired spectrum to increase capacity and user throughputs.
- **Increased spectral efficiency.** Newer technologies are spectrally more efficient, meaning greater aggregate throughput in the same amount of spectrum. Wireless technologies such as LTE, however, are reaching the theoretical limits of spectral efficiency and future gains will be quite modest, allowing for a possible doubling of LTE efficiency over currently deployed versions.
- **Combining uplink gains with downlink carrier aggregation.** Operators can increase network capacity by applying new receive technologies at the base station (e.g., large scale antenna systems) that do not necessarily require standards. This can be combined with added capacity on the downlink from carrier aggregation. This type of deployment flexibility suggests that regulators should consider licensing just downlink spectrum in some cases, since that is where it is generally most needed.
- **Wi-Fi.** Wi-Fi networks offer another means of offloading heavy traffic, especially as the number of Wi-Fi hotspots increases and connections become more seamless. Wi-Fi adds capacity since it offloads onto unlicensed spectrum. Moreover, since Wi-Fi signals cover only small areas, Wi-Fi achieves both extremely high frequency re-use, as well as high bandwidth per square meter across the coverage area.
- **Off-peak hours.** Operators can offer user incentives or perhaps fewer restrictions on large data transfers that occur at off-peak hours such as overnight.
- **Quality of service (QoS).** By prioritizing traffic, certain traffic such as non-time-critical downloads can execute with lower priority, thus not affecting other active users.
- **Innovative data plans.** Creative new data plans influencing consumption behavior including tiered pricing make usage affordable for most users, but discourage excessive or abusive use.
- **Explore new methods for the future.** Recently there has been a considerable amount of discussion about spectrum sharing. Although a promising approach for better spectrum utilization in the long term, spectrum sharing will require new technologies, as well as spectrum coordination, items that could take ten years or more to develop and commercialize.

It will take a creative blend of all of the above to make the mobile broadband market successful and to enable it to exist as a complementary solution to wired broadband.

VI. BENEFITS

To ensure that the goal for access to broadband is met, the Federal Communications Commission (FCC) is reaching out to businesses, consumers and municipalities alike so that no community is left behind. Broadband deployment is so crucial because of the many ways it touches people's lives. Broadband services provide users high-speed access to data, video, audio and voice services all over one connection and bringing tremendous benefits and achieving important goals.

- ***Education***. Distance learning and Internet research are enabled, allowing students anywhere to access resources and obtain realtime instruction from qualified educators that might not otherwise be available in their local community.
- ***Healthcare***. Remote or small clinics can be connected to experts and medical centers throughout the country, broadening access to medical expertise and specialties.
- ***Jobs & Productivity***. The availability of broadband access is critical to attracting new businesses and giving existing businesses the ability to compete. With broadband access, worker productivity increases, jobs are created, and wages and the tax base grow.
- ***Homeland Security***. Local public safety officials can get timely access to the information they need to assess and act on threats. In times of crisis or a natural

ISSN: 2278-0181
Vol. 2 Issue 3, March - 2013

disaster, getting accurate information to residents can be a life saver. Informed citizens are better prepared to help themselves and their neighbors in times of need.

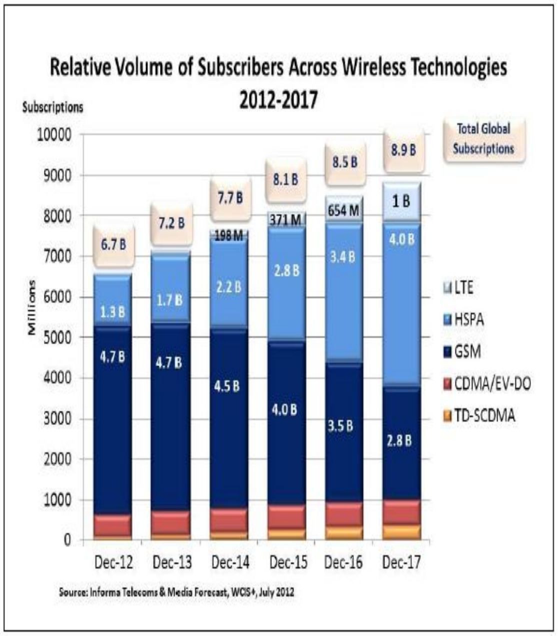

Figure 2 : Relative Volume of Subscribers Across Wireless Technologies

VII. HELP BY LOCAL GOVERNMENTS

Local governments can play an active role to bring the advantages of wireless broadband to their citizens.

- ***Permits***. In order to deploy a wireless network, operators typically must mount small, safe antennas to towers, buildings, or other tall structures and, in many cases, on their customers' rooftops. A WISP may need the appropriate permits for the placement of antennas necessary to ensure system coverage. With respect to equipment on the customer's premises, however, federal regulations generally prohibit local jurisdictions from requiring permits.
- ***Access to Rights-of-Way and Public Property****:* Sometimes local governments control access to the most beneficial structures (such as a water tower or high rooftop) that would enable a WISP to reach a large portion of the community. Some WISPS may also use access to smaller structures in rights-of-way, such as streetlights or telephone poles to set up their networks.
- ***Flexibility:.*** WISPs often vary in size and use different and multiple frequencies. They may have very different requirements and economies than the cellular telephone and other operators with whom local governments may be accustomed to dealing. In order to bring the benefits of broadband to their communities, municipalities may need to work closely with the WISP to ensure that the WISP is able to move forward and that the greatest benefit is brought to the community in terms of service.

CONCLUSION

Mobile broadband has become the leading edge in innovation and development for computing, networking, and application development. There are now more smartphones shipped than personal computers. As smartphones and other mobile platforms, such as tablets, increase their penetration levels, they will continue driving explosive growth in data usage, application availability, 3G/4G deployment, and revenue.

The growing success of mobile broadband, however, mandates augmentation of capacity to which the industry has responded by using more efficient technologies, deploying more cell sites, planning for sophisticated heterogeneous networks, and offloading onto either Wi-Fi or femtocells. Some governments that want to lead the mobile broadband technology revolution have responded with ambitious plans to supply more spectrum, while other governments still need to do more by providing more harmonized spectrum soon.

At the end of the Broadband Wireless Era, billions of people worldwide will be communicating wirelessly using devices and services not yet designed. Many of these people will have access to multiple technologies that will allow them choices for an always best-connected advantage. Intel and the members of the Intel Communications Alliance are helping define the Broadband Wireless Era through innovative, wireless-optimized silicon building blocks and platforms, collaboration with other industry leaders on technology and infrastructure design, and the development of new standards.

REFERENCE

[1] A. Yarali, S. Rahman and B. Mbula, "WiMAX: The Innovative Broadband Wireless Access Technology", JOURNAL OF COMMUNICATIONS, VOL. 3, NO. 2, pp: 53-63, APR. 2008

[2] Brewer E, Demmer M, Du B, Ho M, Kam M, Nedevschi S, et al. The case for technology in developing regions. Silver Spring, MD: IEEE Computer Society Press; 2005. p. 25–38.

[3] G. Singh and J. Singh "Comparative Analysis of Broadband Wireless Technologies", International Journal of Computer Science & Technology, IJCST, pp: 69-72 Vol. 2, Issue 4, Oct . - Dec. 2011.

[4] L. Bai," Analysis of the Market for WiMAX Services", Thesis, Lyngby, Denmark, May 2007

[5] Mehmet S. Kuran and Tuna Tugcu "A survey on emerging broadband wireless access technologies", Science Direct , Elsevier Science, 2007

[6] Vinoth Gunasekaran, Fotios C. Harmantzis "Emerging wireless technologies for developing countries", Elsevier,Technology in Society 29 (2007) 23–42

[7] WiMAX technology overview: (www.intel.com/netcomms/technologies/wimax)

[8] Rensburg, J.J (2006),"Investigation of the Deployment of 802.11 Wireless Networks", M.Sc Thesis. University of Rhodes: Ghramstown, South Africa.

[9] Chan, H.A (2005),"Overview of Wireless Data Network Standards and their Implementation Issues", SATNAC Proceedings.

[10] Intel Corp (2003), "IEEE 802.16 and WiMAX: Broadband Wireless Access for Everyone", [Online] Available http:// www.intel.com/ebusiness/pdf/wireless/intel/80216_ wimax.pdf

[11] Black Box (2005), "802.11: Wireless Networking", White Paper, [Online] Available http://www.blackbox.com/Tech_ Support/White Papers/802.11-Wireless-Networking2. pdf

[12] D.V. Chandra Shekar, V. J. (2005-2008),"Wireless security: A comparative analysis for the next generation networks", Journal of Theoretical and Applied Information Technology.

[13] White paper, "Understanding WiMAX and 3G for Portable/Mobile Broadband Wireless", Intel, December 2004

[14] P. Yegani, Cisco Systems white paper, "WiMAX Overview," IETF-64 Nov. 7-11, Vancouver, Canada, 2005, pp. 4.

[15] Rao B, Parikh MA. Wireless broadband drivers and their social implications. Technol Soc 2003;25:477–89.

[16] Pentland A, Fletcher R, Hasson A. DakNet: rethinking connectivity in developing nations. Silver Spring, MD: IEEE Computer Society Press; 2004. p. 4–9

[17] N. Cohen, "What Works: Grameen Telecom's Village Phones," World Resources Inst., 2001, http://www.digitaldividend.org/pdf/grameen.pdf.

[18] M.H. Akhand, "Disaster Management and Cyclone Warning System in Bangladesh," *Early Warning Systems for Natural Disaster Reduction*, J. Zschau and A.N. Kuppers, eds., Springer, 2003.

[19] C. Smith, D. Collins, 3G Wireless Networks, second ed., McGraw-Hill Osborne Media, 2006

[20] Q. Ni, L. Romdhani, T. Turletti, A survey of QoS enhancements for IEEE 802.11 wireless LAN, Wiley Journal of Wireless Communications and Mobile Computing 4 (5) (2004) 547–566.

[21] A.S. Tanenbaum, Computer Networks, fourth ed., Prentice Hall, 2003.